

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: :
 : Group Art Unit: 1753
 Robert Sheffield et al. :
 : Examiner: Luan V. Van
 Appln. No.: 10/667,491 :
 : Confirmation No.: 1242
 Filed: September 23, 2003 :
 : Customer No.: 21967
 For: REDUCED CIRCUIT TRACE :
 :
 ROUGHNESS FOR IMPROVED SIGNAL :
 :
 PERFORMANCE :

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REPLY BRIEF

Sir:

This Reply Brief is submitted in response to the Examiner's Answer dated April 13, 2009.

STATUS OF CLAIMS

Claims 1, 2, 4-6, 19, and 20 are currently pending in the above-identified patent application. Claims 3 and 7-18 were previously cancelled. Claims 1, 2, 4-6, 19, and 20 were finally rejected in an Office Action dated October 21, 2008.

The rejections of claims 1, 2, 4-6, 19, and 20 are appealed.

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

The following grounds of rejection are to be reviewed on appeal:

- The rejection of claims 1, 2, 4-6, 19, and 20 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Tanaka et al. (U.S. Patent No. 4,959,507, hereinafter "Tanaka").
- The rejection of claims 1, 2, 4-6, 19, and 20 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Tanaka in view of Nagai et al. (U.S. Publication No. 2002/0155021, hereinafter "Nagai").

ARGUMENT

The Examiner's Answer dated April 13, 2009 has been received and carefully considered.

As discussed below, it is respectfully submitted that the Office has failed to establish a prima facie case of obviousness against the appealed claims. Specifically, the Examiner's Answer continues to improperly allege that Tanaka teaches each and every claim limitation of independent claim 1.

Specifically, claim 1 expressly recites that "the surface roughness of the at least one surface is reduced to no more than

20 microinches root-mean-squared (RMS)." Regarding claim 1, the Examiner asserts that Tanaka teaches all the limitations of the claimed invention, except that Tanaka "differs from the instant claim in that the reference does not explicitly teach the narrower range of roughness of the instant claim." The Examiner alleges that "the range of roughness of Tanaka (a surface roughness of no more than 254 microinches encompasses the range of roughness of the instant claim (a surface roughness of no more than 20 microinches)" and asserts that "this encompassing...is prima facie obviousness over the range of the instant claim." The Examiner then cites MPEP 2144.05 as support for its allegation. However, Appellants respectfully disagree.

Tanaka's range of roughness does not "encompass" the range of the instant claims, as alleged by the Examiner. Furthermore, Nagai fails to cure the deficiencies of Tanaka because Nagai also fails to teach that "the surface roughness of the at least one surface is reduced to no more than 20 microinches root-mean-squared (RMS)." Similar to Tanaka's range of roughness, Nagai's range of roughness does not "encompass" the range of the instant claims, as alleged by the Examiner. The MPEP 2144.05 states that "a prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." Here, the asserted "prior art

reference" is Tanaka and it does not disclose a range that is "somewhat narrower" than that of the instant claim. Rather, Tanaka's range of roughness of "no more than 254 microinches," is significantly larger than that of the instant claim, which recites "no more than 20 microinches" (emphasis added). In other words, Tanaka's range is more than twelve (12) times that of the range recited in the instant claim. Nagai's range of roughness of "no more than 97 microinches" is also significantly larger than that of the instant claim. Nagai's range is more than four (4) times that of the range recited in the instant claim. Thus, the claimed range is not "somewhat narrower" than the range taught by either Tanaka or Nagai.

In fact, the claimed range provides new and unexpected results not taught or even contemplated by Tanaka or Nagai. The Examiner's Answer, however, alleges that Appellants unexpected result argument is not persuasive. According to the Examiner's Answer, because "a high surface roughness adversely affects the performance of a high-frequency device and that the desired performance is achieved with a roughness of less than 2 micrometers (paragraph 28)...surface roughness is a cause effective variable, and since Nagai et al. teaches that lower roughness yields better performance, it would have been obvious to one having ordinary skill in the art at the time the

invention was made to have reduced the surface roughness as much as possible through routine experimentation in order to optimize the performance of the high-frequency device." However, Appellants respectfully disagree.

For example, the claimed range provides new and unexpected results since transmitting signals on conductors of the claimed invention may often exhibit a phenomenon known as "skin effect," whereby self-inductance of the conductors forces electrons toward the surface of the conductors. Skin effect may be particularly prevalent in conductors transmitting high-frequency signals. For example, it has been found that for a copper conductor, the depth from the surface at which the majority of electrons flow (i.e., the "skin depth") may be approximately 2 microns for a 1 gigahertz (GHz) signal, 0.66 microns for a 10 GHz signal, and 0.33 microns for a 40 GHz signal. See, e.g., Specification, page 1.

Skin effect may restrict current to only a relatively small portion of the total cross-sectional area of a conductor. Conductors, however, may frequently exhibit a surface roughness that may extend into the skin depth of the conductors. As a result of this surface roughness, the mean free path traveled by electrons exhibiting skin effect may increase in length as the electrons travel up and down contours of the rough surface of

the conductor. This increase in the effective signal path may result in corresponding increases in resistance to the flow of current and transmission time and, consequently, decreases in signal reach and performance. See, e.g., Specification, pages 1-2.

In at least one embodiment, as depicted in Fig. 1B of the present application, one or more surfaces of circuit trace 112B may be polished to reduce their surface roughness. For example, the surface of the circuit trace 112B may be polished to have a roughness of approximately 20 microinches or less, approximately 10 microinches or less, or approximately 5 microinches or less. These dimensions are reflected in claims 1, 4, and 5, respectively. See, e.g., Specification, pages 9-10.

Accordingly, the polished top surface 122B and the polished bottom surface 124B of Fig. 1B may exhibit a significantly reduced surface roughness compared to the surfaces 122A, 124A of the unpolished circuit trace 112A of Figure 1A. Consequently, the electron paths 132B, 134B traveled by electrons at skin depth along the top surface 122B, 124B, respectively, may be significantly shorter compared to the corresponding electron paths 132A, 134A of the unpolished circuit trace 112A. The reduction in the mean free path traveled by the electrons may then result in the reduction of resistance to the current of the

signal 114 and, therefore, an increase in the signal reach and a decrease in signal distortion. In fact, it should be appreciated that the improvement in the transmitted signal may, in certain instances, result in up to 20% improvement for lateral smoothing while signal improvements resulting from transverse polishing may improve 50% or more. See, e.g., Specification, pages 10-11.

These are clearly new and unexpected results not taught or even contemplated by Tanaka or Nagai. Although Nagai recognizes the importance of a reduced surface roughness, Nagai's system nevertheless fails to achieve clearly new and unexpected results achieved by the instant claims. In fact, to reiterate, nothing in Tanaka or Nagai teach "the surface roughness of the at least one surface is reduced to no more than 20 microinches root-mean-squared (RMS)," as expressly recited in claim 1. At best, Tanaka and Nagai teach nothing more than a traditional technique.

As a result, the claimed range is a critical limitation having new and unexpected results not taught by Tanaka and/or Nagai. Therefore, Tanaka and/or Nagai do not and cannot be understood as "encompassing" the range of the instant claim, as alleged by the Examiner. Accordingly, the Examiner has misapplied these references and has therefore failed to

establish a proper prima facie case of obviousness for independent claim 1.

Regarding claims 2, 4-6, 19, and 20, these claims are dependent upon independent claim 1. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071 (Fed. Cir. 1988). Thus, since independent claim 1 should be allowable as discussed above, claims 2, 4-6, 19, and 20 should also be allowable at least by virtue of their dependency on independent claim 1. Moreover, these claims recite additional features which are not disclosed, or even suggested, by the cited references taken either alone or in combination. For example, claim 2 recites reducing the surface roughness by electropolishing the at least one surface, electrochemical polishing the at least one surface, electroplating the at least one surface, or vacuum depositing conductive material on the at least one surface. Tanaka, alone or in combination with Nagai, fails to disclose any of these claimed techniques. Also, claim 4 recites "the surface roughness of the at least one surface is reduced to no more than 10 microinches root-mean-squared (RMS)," and claim 5 recites "the surface roughness of the at least one surface is reduced to no more than 5 microinches root-mean-squared (RMS)." Tanaka, alone or in combination with Nagai,

also fails to disclose any of these claimed surface roughnesses. Further, claim 6 recites that the at least one surface of the conductive circuit trace includes a surface parallel and proximal to the surface of the circuit board or a surface perpendicular to the surface of the circuit board. Tanaka, alone or in combination with Nagai, further fails to disclose polishing either of these claimed surfaces.

In view of the foregoing, it is respectfully requested that the aforementioned rejection of claims 1, 2, 4-6, 19, and 20 be withdrawn.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the Examiner has failed to establish a prima facie case of obviousness against the appealed claims. Thus, it is respectfully submitted that the final rejection of claims 1, 2, 4-6, 19, and 20 is improper and the reversal of same is clearly in order and respectfully requested.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made.

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